Original Article

Correlation of Hemoglobin & C-Reactive Protein Levels with In-hospital Outcome of Patient with Acute Coronary Syndrome

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Abstract

Background: Haemoglobina and CRP level may be related with the in-hospital outcome of acute coronary syndrome patients. **Objective:** The purpose of the present study was to correlate haemoglobin and CRP level with in-hospital outcome of patient with acute coronary syndrome. **Methodology:** This cross-sectional study was conducted in the Department of Cardiology at Mymensingh Medical College, Mymensingh, Bangladesh from December 2010 to November 2011 for a period of two (02) years. Patients of ACS who were presented within 12 hours of chest pain were included as study population. Study population were categorized in four groups according to the level of hemoglobin and C-reactive protein. Blood sample was collected for baseline laboratory investigations. **Result:** The mean age of the population was 52.18±8.88 years. Arrhythmia was more common in Group 1 which was 5(71.4%) cases and 6(46.2%) cases in VT and AF respectively. Arrhythmia was significantly correlated with age, sex, diabetes mellitus & CRP. Death was significantly correlated with age, diabetes mellitus, hypertension & CRP. Heart failure was significantly correlated with family history of IHD, CRP & Hemoglobin. Bleeding was only significantly correlated with CRP. No significant association was revealed between the types of arrhythmia and age, sex, smoking, diabetes, dyslipidaemia, family history of IHD and hypertension (P = 0.087). Only heart failure was strongly and significantly correlated with hemoglobin level (p=0.000). Bleeding (p=0.003), heart failure (p=0.022) and death (p=0.016) were significantly correlated with CRP level. **Conclusion:** In conclusion there is a correlation of haemoglobin and CRP level with in-hospital outcome of patient with acute coronary syndrome. *[Journal of Science Foundation 2019;17(1):3-8]*

Keywords: Correlation; Hemoglobin; C-Reactive Protein; In-hospital Outcome; Acute Coronary Syndrome

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Introduction

The coronary heart disease is the leading cause of morbidity and mortality in western society and is a worldwide health epidemic. They are emerging as major health problem in developing countries like Bangladesh (Amanullah et al., 1987). By 2020, it is estimated that it will be major cause of death in all regions of the world (Bloomifield et al., 2006).

The incidence of coronary heart disease (CHD) is high and ranks number 2 in frequency as the cause of death in official vital statistics after cancer in developed countries. Worldwide 30 % of all death can be attributed to cardio vascular disease of which more than half are caused by CHD. Globally of these dying from cardiovascular diseases 80.0% are in developing countries and not in the western world (Gandotta and Miller 2004).

There are many studies on hemoglobin level connected with coronary artery disease. Anemia is an independent risk factor for cardiovascular disease out come in the atherosclerosis risk in community cohort, community cohort subjects between the ages of 45 and 64 years. (Frnanklin et al., 2004). Anemia and reduced kidney function occur frequently in patient with heart failure. Decreased Kidney function and anemia are risk factor for all-because mortality is patient with LV dysfunction especially both are present (Anker et al., 2009).

In unstable angina CRP is a strong independent marker of increased 90 days risk. Compared with CRP at admission CRP at discharge is better related to later outcome and could be great utility for risk stratification (Frnanklin et al., 2004). This present study was undertaken to correlate haemoglobin and CRP level with in-hospital outcome of patient with acute coronary syndrome.

Methodology

This comparative cross-sectional study was conducted in the Department of Cardiology at Mymensingh Medical College, Mymensingh, Bangladesh from December 2010 to November 2011 for a period of two (02) years. Patients of ACS who were presented within 12 hours of chest pain were included as study population. Patient who were admitted in CCU with clinical features of ischaemic type of chest pain of both sexes within 12 hours of onset of chest pain and diagnosed as ACS were included in this study. Patients with iron therapy before admission, blood transfusion before admission, History of previous or current haemostatic disorder, patient with recent bleeding, renal insufficiency, patient admitted with Chronic disease or inflammatory condition, Patient with malignancy, history of PCI or history of CABG were excluded from this study. All the data were recorded in a data collection sheet. Study population were categorized in four groups according to the level of hemoglobin and C-reactive protein. Patients who had less than 10 gm/dl haemoglobin level and more than or equal to 12 mg/L of CRP were designated as Group I. Patients who had more than 10 gm/dl haemoglobin level and less than 12 mg/L of CRP were designated as Group II. Patients who had more than 10 gm/dl haemoglobin level and more than or equal to 12 mg/L of CRP were designated as Group III. Patients who had less than 10 gm/dl haemoglobin level and less than 12 mg/L of CRP were designated as Group IV. Age, sex, cardiovascular risks factor, history, family history of cardiovascular disease, treatment history and ECG were taken during admission. Blood sample was collected for baseline laboratory investigations like Troponin-I, Random Blood Sugar (RBS), Blood urea, Serum creatinine, lipid profile, Hemoglobin & CRP level. Sample were then send to standard laboratory /Biochemistry department of MMCH. The period of follow up was 5 days after admission. Student's unpaired 't' test was used for analysis of continuous variables. Comparison between groups was done by unpaired t-test. Multivariate logistic regression analysis was done to determine the association of Hemoglobin & CRP Levels with in hospital out come in Acute Coronary Syndrome. Avitex CRP (Omega Diagnostics Ltd. Scotland. UK) is a rapid latex agglutination test kit for detection of C-reactive protein in human serum. The detection limit is 6mg/L. Hemoglobin estimation was done by analyzer.

Result

Majority of the study population were in the age group of 41 to 50 Years and 51 to 60 Years of age group which were 73(36.3%) cases in each followed by 61 to 70 Years which was 33(16.4%) cases. The mean age

of the population was 52.18±8.88 years. Statistically non-significant mean age difference among the groups (Table 1).

Table 1: Age Distribution of the Study Population

Age Group	Group				Total
	Group 1	**Group 2**	**Group 3**	**Group 4**	
30 to 40 Years	11 (14.7%)	6 (6.5%)	5 (22.7%)	0 (0.0%)	22 (10.9%)
41 to 50 Years	23 (30.7%)	38 (41.3%)	7 (31.8%)	5 (41.7%)	73 (36.3%)
51 to 60 Years	28 (37.3%)	33 (35.9%)	8 (36.4%)	4 (33.3%)	73 (36.3%)
61 to 70 Years	13 (17.3%)	15 (16.3%)	2 (9.1%)	3 (25.0%)	33 (16.4%)
Total	75(100.0%)	92(100.0%)	22(100.0%)	12(100.0%)	201(100.0%)

*Mean±SD = 52.18±8.88; χ^2 = 9.56, P = 0.39 NS; Group 1=Hb < 10 gm/dl CRP ≥ 12 mg/L; Group 2=Hb > 10 gm/dl CRP< 12 mg/L; Group 3=Hb > 10 gm/dl   CRP > 12 mg/L; Group4= Hb < 10 gm/dl   CRP< 12 gm/L

The in-hospital outcome of arrhythmia, mechanical complication, stroke, bleeding and death were recorded. Arrhythmia was more common in Group 1 which was 5(71.4%) cases and 6(46.2%) cases in VT and AF respectively. Mechanical complication was only found in Group 2 which was 1(100.0%) case. Stroke was more in Group 1 which was 2(66.6%) cases; bleeding was only reported in group 1 which was 2(100.0%) cases. Death was more found in group 1 which was 5(71.4%) cases. Findings were not statistically significant (p=0.695) (Table 2).

Table 2: Distribution of the study population by types of Arrhythmia Mechanical complication Stroke Bleeding Death

Variables	Group Name				Total
	Group 1	**Group 2**	**Group 3**	**Group 4**	(n = 201)
No Arrhythmia	63(35.6%)	84 (47.5)	19 (10.7%)	11 (6.2%)	117 (100.0%)
VT	5 (71.4%)	2 (28.6)	0 (0.0%)	0 (0.0%)	7 (100.0%)
AF	6 (46.2%)	4 (30.8)	2 (15.4%)	1 (7.7%)	13 (100.0%)
Complete Heart block	2 (50.0%)	1(25.0)	1 (25.0%)	0 (0.0%)	4 (100.0%)
Mechanical Complication	0(0.0%)	1(100.0%)	0(0.0%)	0(0.0%)	1(100.0%)
Stroke	2(66.6%)	1(33.3%)	0(0.0%)	0(0.0%)	3(100.0%)
Bleeding	2(100.0%)	0(0.0%)	0(0.0%)	0(0.0%)	2(100.0%)
Death	5(71.4%)	2(28.6%)	0(0.0%)	0 (0.0%)	7 (100.0%)

X^2 = 6.444; P = 0.695; Group 1=Hb < 10 gm/dl CRP ≥ 12 mg/L; Group 2=Hb > 10 gm/dl CRP< 12 mg/L; Group 3=Hb > 10 gm/dl CRP > 12 mg/L; Group4= Hb < 10 gm/dl   CRP< 12 gm/L; AF=Atrial Fibrillation; VT=Ventricular Tachycardia

Arrhythmia was significantly correlated with age, sex, diabetes mellitus & CRP. Death was significantly correlated with age, diabetes mellitus, hypertension & CRP. Heart failure was significantly correlated with family history of IHD, CRP & Hemoglobin. Bleeding was only significantly correlated with CRP (Table 3).

Table 3: Correlation of Independent Variables with In-Hospital Outcomes

Independent Variable	Outcome	Chi-square value	P	Independent Variable	Outcome	Chi-square value	P
Age	Arrhythmia	28.30	0.001*	**Dyslipidaemia**	Arrhythmia	2.741	0.433
	Bleeding	2.45	0.485		Bleeding	0.084	0.922
	Heart failure	11.20	0.512		Heart failure	8.972	0.062
	Mechanical complication	1.76	0.623		Mechanical complication	0.042	0.960
	Stroke	4.94	0.176		Stroke	0.169	0.819
	Death	18.90	0.000*		Death	0.301	0.749
Sex	Arrhythmia	15.41	0.001*	**F/H of IHD**	Arrhythmia	3.302	0.387
	Bleeding	.327	0.740		Bleeding	1.27	0.343

	Heart failure	2.70	0.610		Heart failure	10.807	0.029*
	Mechanical complication	0.163	0.861		Mechanical complication	0.234	0.811
	Stroke	0.661	0.546		Stroke	0.951	0.429
	Death	0.001	0.656		Death	1.691	0.225
Smoking	Arrhythmia	1.76	0.635	**CRP**	Arrhythmia	41.227	0.001*
	Bleeding	1.74	0.287		Bleeding	101.40	0.000*
	Heart failure	4.57	0.335		Heart failure	40.71	0.018*
	Mechanical complication	1.17	0.463		Mechanical complication	0.975	0.987
	Stroke	0.023	0.631		Stroke	1.87	0.937
	Death	0.914	0.289		Death	39.97	0.000*
DM	Arrhythmia	9.73	0.021*	**Hb**	Arrhythmia	3.55	0.314
	Bleeding	3.86	0.117		Bleeding	2.65	0.186
	Heart failure	6.59	0.161		Heart failure	23.88	0.000*
	Mechanical complication	0.525	0.657		Mechanical complication	0.767	0.567
	Stroke	0.445	0.425		Stroke	0.556	0.418
	Death	13.874	0.000*		Death	2.34	0.127
Hypertension	Arrhythmia	0.870	0.833	***significant**			
	Bleeding	2.814	0.173				
	Heart failure	6.789	0.147				
	Mechanical complication	0.722	0.582				
	Stroke	1.850	0.198				
	Death	10.102	0.002*				

No significant association was revealed after multivariate logistic regression between the types of arrhythmia and age, sex, smoking, diabetes, dyslipidaemia, family history of IHD and hypertension; F = 1.872, P = 0.087). Thus no prediction was possible (Table 4).

Table 4: Correlation of Hb level with Age, Sex, Smoking, Diabetes, Hypertension, Dyslipidaemia & F/H of IHD

Model	Sum of Squares	df	Mean Square	F	P value
Regression	9.242	6	1.540	1.872	0.087
Residual	159.634	194	0.823		
Total	168.876	200			

ANOVA was performed; Predictors: (Constant), Sex of the patient, Diabetes, present or absent, Hypertension, present or absent, Dyslipidaemia, present or absent, Family H/O IHD, present or absent, Age in years; dependent Variable: Arrhythmia± & type of arrhythmia

Multivariate logistic regression revealed that only heart failure was strongly and significantly correlated with hemoglobin level (p=0.000). Arrhythmia (p=00.885), mechanical complication (p=0.971), stroke (p=0.173), bleeding (p=0.762) and death (p=0.176) were not significant. Multivariate logistic regression revealed that bleeding (p=0.003), heart failure (p=0.022) and death (p=0.016) were significantly correlated with CRP level. Arrhythmia (p=0.171), mechanical complication (p=0.508) and stroke (p=0.508) were not significant (Table 5).

Discussion

This prospective observational study was carried out in the department of cardiology, Mymensingh Medical College Hospital, Mymensingh during the period of December 2010 to November 2011. This study was done to find out the correlation of hemoglobin and C-reactive protein with acute coronary syndrome and in hospital outcome.

Table 5: Multivariate analysis of Hb and CRP with in-hospital outcome

Independent Variable	Outcome	Sum of Squares	F	P value
Hb	Arrhythmia	0.018	0.021	0.885
	Bleeding	0.001	0.092	0.762
	Heart Failure	23.436	15.870	0.000*
	Mechanical complication	6.722E-06	0.001	0.971
	Stroke	0.037	1.873	0.173
	Death	0.059	1.844	0.176
CRP	Arrhythmia	1.588	1.886	0.171
	Bleeding	0.084	8.759	0.003*
	Heart Failure	7.858	5.321	0.022*
	Mechanical complication	0.002	0.440	0.508
	Stroke	8.734E-05	0.440	0.508
	Death	0.191	5.938	0.016*

Among the admitted patient in coronary care unit Mymensingh Medical College Hospital, a total of 201 patient diagnosed as acute coronary syndrome including unstable angina, non-ST elevation myocardial infarction & ST elevation myocardial infraction were included in the study after considering the inclusion and exclusion criteria. The patients were divided in to 4 groups Group-I, Group-II, Group-III and Group-IV according to level of hemoglobin and C-reactive protein level. Among the 201 patient 75 patients were in Group-I (Hemoglobin <10 gm/dl, CRP $\geq$ 12 mg/L), 92 patients in Group-II (Hemoglobin > 10 gm/dl, CRP <12 mg/L,) 22 patients in Group-III (Hemoglobin> 10 gm/dl, CRP > 12 mg/L,) 12 patients included in Group-IV (Hemoglobin: <10 gm/dl, CRP < 12 mg/L).

There was no significant difference of age distribution between these groups. The mean age of the patients was 52.18±8.88 years. The highest percentage of Group-I were 51 to 60 years, and Group-II were 41-50 years, Grech and Ramsdali (2003) found the mean age of the ACS patients were 53.60±8.5 in Bangladeshi population. Paul 2008 found the mean age of ACS patients were 53.2±10.6 years in Bangladeshi population which supported the finding of present study.

The incidence of ventricular tachycardia, atrial fibrillation (AF) and complete heart block (CHB) were higher in Group-I than other groups. The incidence of ventricular tachycardia (Group-I, 71.4%, Group-II 28.6%) atrial fibrillation. (Group-I 46.2%, Group-II 30.8% Group-III 15.4% and Group-IV 7.7%) were more is Group-I than other groups. Complete heart block (CHB) was more in Group-II. But there was no significant difference regarding the presence of arrhythmia.

In hospital mortality is one of the outcome of this study. Mortality was higher in Group-I (71.4%) than Group-II (28.6%) since there was no mortality in Group-III and Group-IV, mortality was not statistically significant. Cox and Nelson (2008) found that lower hemoglobin concentration were associated with higher mortality is patients with acute myocardial infraction. They found a statistically significant increase in 30 day mortality in patient presenting with hemoglobin concentration lower than 10 gm/dL.

Arrhythmia was significantly correlated with age, sex, diabetes mellitus and CRP. Death was significantly correlated with age, diabetes mellitus, hypertension and CRP. Heart failure was significantly correlated with family history of IHD, CRP and hemoglobin. Bleeding was only significantly correlated with CRP. Multivariate logistic regression revealed that only heart failure was strongly and significantly correlated with hemoglobin level (p=0.000). Arrhythmia (p=0.885), mechanical complication (p=0.971), stroke (p=0.173), bleeding (p=0.762) and death (p=0.176) were not significant. Multivariate logistic regression revealed that bleeding (p=0.003), heart failure (p=0.022) and death (p=0.016) were significantly correlated with CRP

level. Arrhythmia (p=0.171), mechanical complication (p=0.508) and stroke (p=0.508) were not significant. Multivariate logistic regression revealed that only heart failure was strongly correlated with hemoglobin level. Arrhythmia, mechanical complication, stroke, bleeding and death were not significant. Multivariate logistic regression revealed that heart failure, bleeding and death were correlated with C-reactive protein level. Mechanical complication, arrhythmia and stroke were not significant. In regression analysis it was observed that C-reactive protein was strong predictor of in-hospital outcome. Wu et al (2001) found that highly statistically significant and independent association between low hemoglobin concentration and adverse cardiovascular outcome among the patient with ACS. Their finding was worsening degrees of anemia were associated with progressively higher rates of hypotension tachycardia and heart failure. Fried and Raw (2003) found that the patient group with lower hemoglobin concentration on admission more likely suffered from cardiogenic shock, CCF and post infarction angina than the groups with higher hemoglobin level on admission.

Conclusion

Patient with ACS has variable levels of hemoglobin and C-reactive protein. It was found that patient with lower hemoglobin and higher CRP level have adverse in hospital outcome including heart failure and death. Hemoglobin and CRP count is a simple, affordable and widely available test which is easily done for each and every patient admitted in the hospital.

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